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Formulation and Evaluation of Anti-Aging Topical Cream by using Aqueous Extract of Ipomoea Aquatica

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Abstract: *The growing demand for natural and safe skincare products has driven the cosmetic industry toward the utilization of herbal ingredients with proven therapeutic properties (1) Topical formulations may contribute to the reduction of oxidative stress in the skin. (2) Ipomoea Aquatica have antioxidant activity that is not yet included in a topical formulation. The aim of this study was to evaluate the antioxidant and anti-aging activity of a cream formulation containing aqueous extract of Ipomoea Aquatica*

The aqueous extract of Ipomoea aquatica leaves was prepared by maceration and subjected to preliminary phytochemical screening, confirming the presence of potent antioxidants. The extract was then incorporated into a cream base using the water-in-oil (W/O) emulsion technique. (3) We have formulated three batches of herbal cream F1, F2, F3, with different quantities of ingredients compositions and optimized based on physical characteristics such as color, odor, texture, spreadability, viscosity, pH, and stability under different temperature and storage condition and In vitro antioxidant activity of the extract and the cream formulation was evaluated using the FRAP radical scavenging assay, which indicated a high free radical neutralizing capacity, supporting the anti-aging potential of the formulation. Additionally, the formulation was subjected to accelerated stability testing and showed consistent performance (4)

Keywords: Herbal cream, anti- aging, Ipomoea aquatica, Cosmetic, FRAP Assay

I. INTRODUCTION

The concept of beauty and cosmetics has existed since the dawn of humanity and civilization. Indian herbs and their importance are well-known globally. There is a rising demand for herbal cosmetics in the world market, which are a precious gift from nature. Herbal products have consistently drawn significant interest due to their effectiveness and relatively fewer or no side effects compared to synthetic drugs (5) Ipomoea aquatica Forsk (I. aquatica Forsk) belonging to Convolvulaceae family is a commonly grown green leafy vegetable found throughout India, Ceylon, Tropical Asia, Africa and Australia. This plant is grown as a semi-aquatic plant and found abundantly in marshy areas. I. aquatica Forsk is a rich source of vitamins, minerals, proteins, fibers, carotenes and flavonoids with many health benefits (6) The plant Ipomoea aquatica is a common trailing vine with milky sap belongs to the family Convolvulaceae. The plant is commonly known as aquatica morning glory, Chinese water spinach, Kangkong, morning glory, swamp cabbage, swamp morning glory, water convolvulus, water spinach, etc. The plant is considered to have a wide distribution and grows in moist soils as well as the side-lines of fresh water, ditches, lakes, ponds, marshes and wet rice field. The plant is grown in the wild and is usually grows all-round the year as well as cultivated (7)

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Fig no. [1] leaf of I. Aquatica

fig no. [2] plant of I. aquatica

Fig no. [3] seeds of I. Aquatica

Leafy vegetables are extensively investigated as a newer source of natural antioxidant and for other bioactive compounds of human health benefits (8)

II. HERBAL COSMETIC

Cosmetics are products typically used to enhance the skin's appearance and also to cleanse it. The term cosmetics originates from the Greek word 'Kosmeticos,' which means the process of embellishing. In today's world, herbal remedies have gained popularity globally. There is a rising demand for herbal cosmetics in the international market (9). The history of cosmetics tells a continuous story as they evolved over time. In ancient times, about 3000 BC, humans used colors for decoration to lure the animals they aimed to hunt. They also colored their skin and decorated their bodies to protect themselves and still fear in enemies, whether human or animal. Originally, cosmetics were connected to hunting, warfare, religious practices, and superstition, before eventually being associated with medicine (10). Herbal cosmetics are products that contain phytochemicals from different plant sources. They influence the functions of the skin and provide vital nutrients necessary for maintaining healthy skin and hair. When natural herbs and their extracts are utilized for their fragrance in cosmetic products, they are referred to as herbal cosmetics. (11). Ayurveda offers

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various solutions for managing aging and associated issues. Its texts mention more than 200 herbs, minerals, and oils to support and improve skin health and beauty. Currently, there is a renewed interest in natural products, and in recent years, there has been a significant increase in research on Indian herbs (12).

CREAM

Cream preparations can be applied to the skin. Creams are described as "thick liquid emulsions or solid forms of oil in water or a type of in-oil water" in the same dosage forms that are different from oil and water. Creams serve cosmetic purposes like cleansing, enhancing beauty, improving appearance, providing protection, or having therapeutic effects. These topical formulations are designed for the targeted administration of medication to the deeper layers of the skin or mucous membranes. They are meant to be used sparingly for better drug delivery in specific areas dealing with skin issues (13)

IDEAL PROPERTIES OF HERBAL CREAM

1. It should not have any toxic effects when applied.
2. The particle size should be optimal.
3. They should create an emollient effect.
4. It should be thicker than lotion, holding its shape, like a 50/50 mixture of oil and water.
5. They should apply evenly across the skin.
6. A preservative is required to extend the shelf life.
7. They ought to be compatible with the skin's pH (14).

BENEFITS OF HERBAL CREAM

1. Helps with pimples and acne.
2. Regulates excess oil production.
3. Makes skin feel softer and smoother.
4. Keeps the skin's pH balanced.
5. Good for all skin types.
6. Completely cruelty-free.
7. Readily available.
8. Affordable.
9. Boosts the body's energy levels.
10. A range of phyto-constituents can be included (15).

ANATOMY OF SKIN

Even if you don't think of the skin as an organ, it is made up of tissues that work together as a whole to perform important functions. The integumentary system, which consists of the skin and its supporting tissues, provides overall protection for the body. Connective tissue binds the various layers of cells and tissues in the skin to the structures beneath. The deeper layer of skin contains many blood vessels, making it well supplied with blood. It has many sensory fibers along with sympathetic and autonomic nerve fibers that help in communication between brains. The skin consists of three layers:

• Epidermis
• Dermis
• Subcutaneous (hypodermis) (16)

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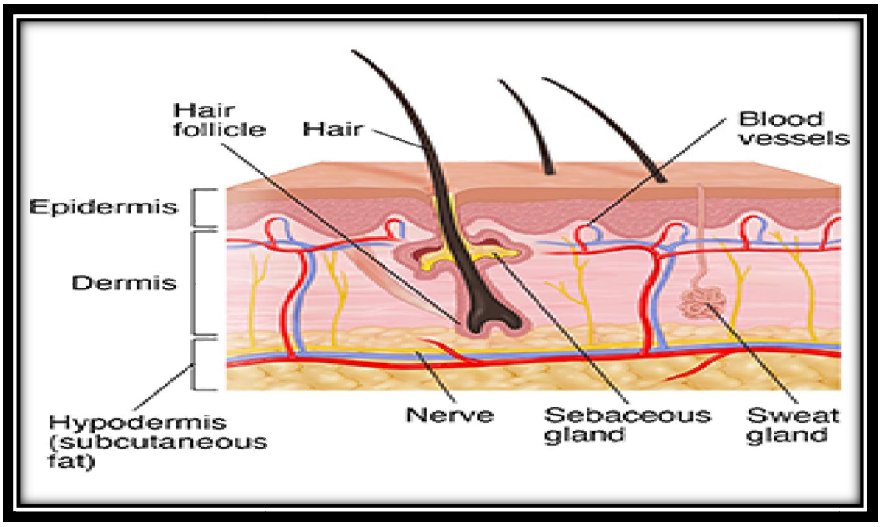

Fig no. [4] Skin Anatomy

PREPRATION OF EXTRACT

Leaves of Ipomoea Aquatica were shade dried at room temperature for 4–5 days. The dried leaves were crushed to coarse powder. Ipomoea Aquatica leaves extract was prepared by boiling 20g leaves of Ipomoea Aquatica in 200 ml of water for 30 min. and then filtered by muslin cloth. Then, the liquid obtained was poured into a China dish and heated gently over the water bath. When the liquid gets evaporated to cool the content and scratches it, the dark brown extract was obtained. The extract stored in refrigerator at 2-8° for subsequential experiment (17)

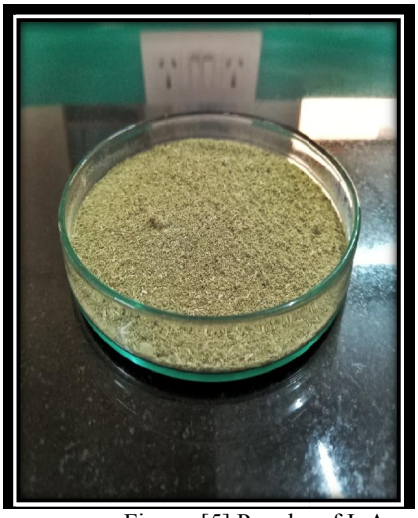

Fig no. [5] Powder of I. Aquatica

Fig no. [6] Extraction of I.

Aquatica

Phytochemical screening of extract of Ipomoea aquatica

Test for Flavonoids

Place the sample extract and a few drops of weak NaOH solution in a test tube. In the test tube, the fluid turns yellow. When a yellow solution is mixed with dilute acid in a test tube, the yellow solution turns colourless, suggesting that flavonoids are present. (18)

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Test for Saponins

The crude sample was diluted with distilled water. The solution was stirred by hand for a few minutes, resulting in the formation of a foam layer on the test tube. The existence of a foam layer can be used to detect saponins (19)

Test for Tannins

The sample extract is diluted with chloroform and almost 1ml of acetic anhydride is added to a test tube. The sulfuric acid is then added to the side of the test tube carefully. The presence of tannins causes the solution to turn green. Another test for tannin is to add bromine water to the sample. The decolorization of bromine water indicates the presence of tannins.

Test for Alkaloids

The substance was warmed and filtered after being treated with HCl. Mayer's reagent (Mercuric chloride + potassium iodide in water) was used to treat this solution. The presence of alkaloids is indicated by the production of a yellow-colored precipitate.

Test for Phenols

In a test tube, the powdered substance was diluted with distilled water. This solution was heated and filtered before use. When a few drops of Ferric chloride are added, the solution turns blue-black, indicating the presence of phenols.

Test for Protein

Perform a biuret test in 2mL of test solution. 2 mL sodium hydroxide solution (4%) and a few drops of copper sulphate solution (1%) were added. The violet/pink color indicates the presence of proteins.

Test for Carbohydrates

Benedict's interrogation (reducing sugar) 2 mL extract was combined with 2 mL Benedict's reagent and boiled in a boiling water bath for 5 minutes. The appearance of green, yellow, orange, or red to brick red color proved the presence of reducing sugar. (20)

FRAP (Ferric Reducing Antioxidant Power) Assay

Antioxidants' capacity to convert ferric ions into ferrous ions is assessed using the FRAP assay. By measuring the reduction potential, this assay can estimate a sample's antioxidant capacity. An increase in reduction potential corresponds to an increase in antioxidant activity

Principle: The FRAP assay is based on the rapid reduction of ferric-tripyridyltriazine (Fe3-TPTZ) in samples by antioxidants, resulting in ferrous-tripyridyltriazine (Fe2TPTZ), a blue-colored product. By adding the FRAP reagent to a range of known concentrations of Fe2+ solutions, a standard curve was produced, allowing the Fe2+ concentration of the samples to be determined and thereby indicating "antioxidant capacity." The FRAP approach was inspired by Benzie and Strain's work. The assay is used for the measurement of the antioxidant potential of various samples. FRAP assay does this, by reducing the ferric ions to ferrous ions through antioxidants present in the samples. Once the ferric iron is reduced, a blue color is developed. (21)

Chemicals and reagents

- 0.2 M, PH 6.6 phosphate buffer
- Potassium ferricyanide (K3Fe(CN)6)
- 10% Trichloroacetic acid
- Distilled water
- 0.1% Fecl3

Method

- only fresh prepared sample is udes for the most accurate and reproducible assay. The extractions from plants can be done using solvent like aqueous.
- The dilution series was made using plant materials.

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• Phosphate buffer 2.5 ml (0.2 M, pH 6.6) was added to all the tubes.
• The contents in each tube were thoroughly mixed.
• Then, 2.5 ml of 1 % potassium ferricyanide K3F(CN)6 solution was added to all the samples.
• After this, shake well each reaction mixture.
• The samples were incubated at 50°C for around 20 minutes.
• Once the incubation time was over, 2.5 ml of 10 % trichloroacetic acid (TCA) was added to each sample.
• The test tubes were well shaken for 10 minutes. From these sample, 2.5 ml supernatant was collected in separate test tubes.
• After this, in the same new separate test tubes, 0.5 ml of ferric chloride (FeCl3) was added.
• This gave us a bluish color formation.
• And then the absorbance was measured at 700nm.
• A sample having more concentration shows more absorbance
• Then, the normalized percentage of antioxidant activity and IC50 values were calculated. (22)

Calculation

Concentration (µg/ml)	Absorbance
10	0.32
20	0.58
30	0.81
40	1.10
50	1.40

Step 1: calculation of % activity

Formula: % Activity $=\frac{Asample}{Amax}x100$

Calculated values

Concentration	% Activity
10	22.8%
20	41.4%
30	57.8%
40	78.5%
50	100%

Step 2: IC50 Calculation

Formula: IC50 = $C_1 + \frac{(50-A_1)(C_2-C_1)}{A_2-A_1}$

IC50= 25.2µg/ml

Result

"The absorbance of the sample at 700 nm was found to be 1.40, indicating strong reducing power and significant antioxidant activity of the extract.

And the IC50 value of the extract was found to be approximately 25.2µg/ml."

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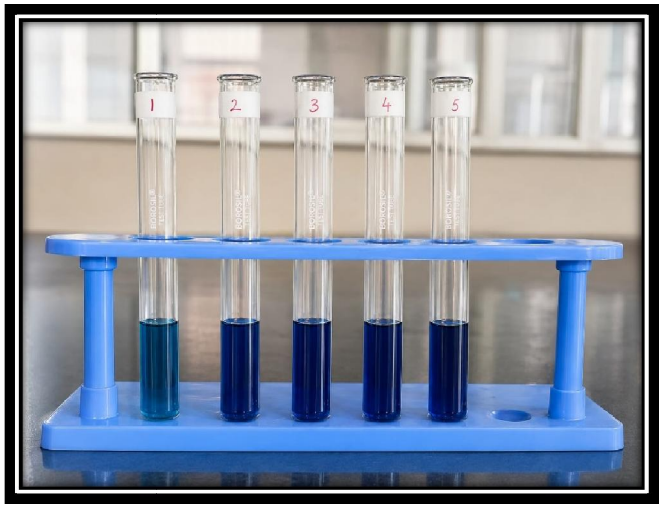

Fig no. [7] FRAP Assay

FORMULATION OF CEEAM

Water in oil(W/O) semi-solid formulation was formulated. For preparation of water phase borax and aqueous extract of ipomoea aquatica is dissolved in purified water by heating the solution on water bath for 70°C. and oil phase is prepared by heating beeswax and liquid paraffin on water bath (70-75°C) until the they melt and completely mix with each other, now for emulsification the aqueous phase was added in portions to the oil phase with continuous stirring until cooling of emulsifier took place.

Sr.no.	Ingredient	Quantity	Role
1	Beeswax	03.2g	Emulsifie, thickener
2	Liquid paraffin	10ml	Emollient
3	Borax	0.16g	Emulsifying agent
4	Purified water	6ml	Vehicle
5	Methyl paraben	0.02g	Preservative
6	Perfume	q.s.	fragrance
7	I. aquatica extract	0.6g	Active ingredient

Fig no. [8] Formulated Cream

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Evaluation parameters of anti-aging herbal cream

Organoleptic Evaluation

The formulated cream was evaluated visually for:

Color: The cream's color is identified through visual inspection.

Odor: The cream's odor is mostly distinctive.

Consistency: A manual rubbing of the cream on the hand is used to assess the formulation. The consistency of the cream is smooth. No oily residue must be left on the skin's surface after the use of the cream.

State: The cream's condition is visually inspected. The cream must be in a semisolid form.

S. No.	property	observation		
		F1	F2	F3
1	colour	Creamish white	Creamish white	Creamish white
2	odour	Pleasant lavender odour	Pleasant lavender odour	Pleasant lavender odour
3	State	Semi-solid	Semi-solid	Semi-solid
4	Texture	smooth	smooth	smooth
5	grittiness	No grittiness	No grittiness	No grittiness

2.pH Determination

- 1 gram of cream was dispersed in 10 ml of distilled water.
- The pH was measured using a calibrated digital pH meter.
- Readings were taken in triplicate, and the mean value was reported.
- Ideal pH range: 5.5 to 6.5, which is compatible with skin pH

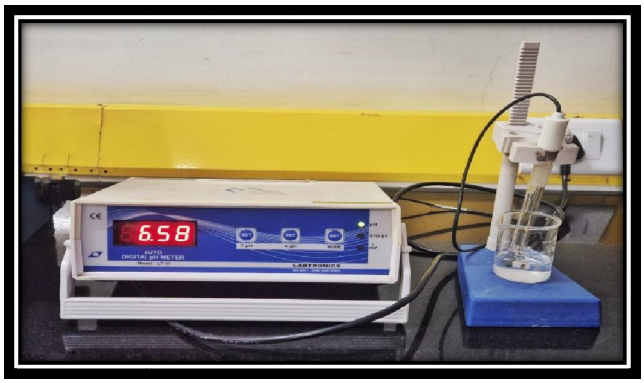

Fig no. [9] Ph of Cream

3. Spreadability

Measured using a glass slide technique to determine how easily the cream spreads on the skin.

Procedure: 1 g of cream was placed between two glass slides.

A 500 g weight was placed on the upper slide for 1 minute.

The diameter or area of spread was measured.

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Fig no. [10] spreading ability of cream

Formula:

S = m× l/t

Were,

S - Spread ability

m- Weight tied to upper glass slide.

L- Length moved on a glass slide

t- Time taken.

The determinations were carried out in three times and the average are readings was recorded and calculate.

Higher spreadability indicates better application properties.

Calculation

Trial	Time (sec)	Spreadability g.cm/sec
1	4	0.50
2	5	0.40
3	6	0.33

4. Homogeneity

A small quantity of cream was pressed between thumb and index finger. Examined for uniform distribution of components.

A homogeneous cream shows no lumps, air bubbles, or phase separation.

5. Washability

Applied to the skin and allowed to remain for a few minutes.

Washed off with tap water to assess how easily the cream could be removed.

A good cream should be non-greasy and washable without soap.

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Fig no. [11] Washability

6. Irritancy Test (Patch Test)

Objective: To check for any allergic reaction or irritation.

Procedure:

A small amount of cream was applied to a clean area of skin on the forearm or behind the ear.

The area was covered with a patch and observed for 24 hours.

Observation:

No signs of redness, itching, inflammation, or irritation should be seen.

SR.No.	Evaluation parameter	observation
1	Colour	Creamish white
2	Odour	Pleasant lavender odour
3	Texture	Smooth, soft
4	Ph	6.5-7.0
5	Spreadability	Good spreadability
6	Stability	Stable with no phase separation
7	Washability	Easily washable with water
8	Irritation	No skin irritation observed
9	Antioxidant activity	Exhibit good antioxidant activity

III. CONCLUSION

In conclusion, the present study successfully formulated and evaluated an anti-aging cream containing aqueous extract of Ipomoea aquatica. The antioxidant activity assessed by the FRAP assay confirmed that the plant extract possesses significant reducing power, indicating the presence of bioactive compounds such as flavonoids and phenolics.

The prepared cream showed satisfactory physicochemical properties, including appropriate pH, good spreadability, and stability, making it suitable for topical application. These results suggest that the incorporation of Ipomoea aquatica extract enhances the antioxidant potential of the formulation, which may help in reducing oxidative stress associated with skin aging. Therefore, the developed herbal cream can be considered a promising natural formulation for anti-aging purposes. However, further studies such as stability testing and clinical evaluation are recommended to confirm its long-term safety and effectiveness

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